Understanding Oil and Gas Liabilities in Alberta March 3 2017

80,000 INACTIVE OIL WELLS:A BLESSING OR A CURSE? Lucija Muehlenbachs Feb 2017

SUMMARY

For a century, oil and gas wells have been Alberta's economic pride. That there could be a hidden cost in maintaining these wells past their productive life is difficult to imagine, much less accept. The financial burden of abandoning a well officially is no doubt why Alberta producers delay doing so as long as possible. Turning a blind eye, they routinely keep non-producing wells in a state of "inactive" suspension and refuse to rule out the possibility that someday oil prices or technology, or both, will change significantly enough to make those wells profitable again. In most cases that will never happen, but the province plays along anyway: It enforces no limit on how long a well can be kept inactive before it must be reactivated or abandoned. While a convenience for well owners, there is no benefit to Albertans. They are exposed to the risk of thousands of inactive wells becoming a hazardous threat to public safety.

The longer a well is inactive, the higher the likelihood that its owner may no longer be around to arrange and pay for its official abandonment, a process whereby wells are permanently sealed using regulated methods that insure they cause no environmental damage. Oil and gas producers come and go. Periodic price shocks, like the one that recently ravaged the sector, drive companies into insolvency. When the owner of an inactive well is no longer around to pay for its abandonment costs, the well becomes orphaned. Alberta's permissive policies
have led to a situation where there are now more than 80,000 inactive wells in the province. Some have been inactive for decades. If the possibility existed that they could eventually become economical, those wells might be considered a blessing. However, the simulations that model scenarios where prices are substantially higher or where production technology is significantly improved, clearly show that the vast majority of these wells will never be reactivated, no matter how dramatically conditions improve.

Recent news reports have raised alarm over the growing number of orphan oil and gas wells in Alberta and the Alberta Energy Regulator (AER) has recently put into place rules that it hopes will stem the rising number of orphan wells.1, 2 An orphan well is a well without a legally responsible party to pay for its final closure.
The media have pointed to the sharp increase in the number of orphan wells as a cause for concern; in the last 24 months, the number of orphan wells awaiting cleanup has increased from 162 to 768.3 However, this number is small when compared to the number of inactive wells in Alberta.4 Inactive wells are wells that have not had any volumetric activity in a year or more but have not yet been permanently closed; these inactive wells, unlike orphan
wells, still have a financially viable owner who is expected to pay for the final closure. As of Nov. 26, 2016, there were 81,602 reported inactive wells in Alberta.5

Creating an industry fund that takes responsibility for a well that has been orphaned has been Alberta's approach to managing all its orphan wells. The deemed liability of 80,000 inactive wells is so large presently that the fund would be insufficient to cover the costs. The only way to prevent the province's vast and growing number of inactive wells from remaining an ongoing risk to the public is by limiting the ability of owners to keep wellsinactive as long as they like. Policies should recognize that most inactive wells will likely never produce oil or gas again.

Plugging, abandoning, and reclaiming a wellsite can be an expensive endeavour, ranging in cost from $50,000 to several million dollars.7 However, a well that has stopped producing need not be immediately plugged, abandoned, and reclaimed; it is possible to “suspend” production.8 Current policies in Alberta do not put a time limit on how long a well can be suspended, allowing wells to be in a suspended state for an indefinite amount of time.9 This is how we have 80,000 wells that have stopped production but have not been permanently cleaned up. Some of these wells have not produced for 60 years, yet according to the AER, their closure is only temporary

The paper finds that only with a drastic, arguably implausible increase in prices and recovery rates will there be a significant increase in the number of reactivated oil and gas wells.This implies that wells are typically left suspended not because of the option to reactivate, but rather to avoid costly environmental obligations, coupled with the fact that there is no penalty for leaving wells suspended indefinitely. Thus, the regulatory requirement (or lack thereof) is introducing a high risk of potential future liability for both the industry and taxpayers as most of these suspended wells are not assets and the longer they are suspended, the longer the operator is exposed to economic fluctuations that could drive it into bankruptcy, leaving these unproductive suspended wells orphaned.

pg2,3

POLICY IN ALBERTA

When a well stops producing, some jurisdictions will allow the well to remain in a temporarily abandoned state so that it need not be immediately plugged, abandoned, and reclaimed. The requirements needed to obtain temporary abandonment vary across jurisdictions, from no requirements at all to needing to cap and plug the wells and perform well-integrity tests.12 In Alberta, if a well has not produced in six to 12 months, depending on type, then operators must follow specific requirements to temporarily abandon the well, or what Alberta terms “suspend” (a process that is one step from plug and abandon).13 In the requirements necessary for temporary abandonment, Alberta is on the stringent end of this spectrum, requiring pressure tests every one to five years depending on risk-level, and requiring medium-risk wells to be plugged.14 With regards to the length of time a well may remain suspended, Alberta is one of the more lenient jurisdictions as it has no limit set on the length of time a well can remain suspended.15 Alberta’s regulator has the authority to order a wellsite to be plugged and
abandoned if the suspended well is not in compliance with regulation; however, this is not a common occurrence and such an order is often rescinded or amended. For example, in 2007 there were only six well-abandonment orders and in 2006 there were 19 well-abandonment orders, but as of June 2009 only two of these wells had been abandoned.16 Therefore, although it is required under the Environmental Protection and Enhancement Act, s. 137, that all wells in Alberta eventually be abandoned and reclaimed, it is effectively up to the operator to decide on the time frame.

One issue with allowing for indefinite suspension of inactive wells is that inactive wells are more likely to become orphaned. If, instead of reclaiming a well, an operator leaves it suspended, unpredictable swings in the price of oil like those we have experienced in recent years can drive many once-productive operators into bankruptcy. Productive wells are more likely to be sold, with the proceeds collected by creditors, and inactive wells are more likely to be orphaned. The longer the well is suspended, the more likely it will encounter a low oil price.

This problem has been magnified by the Alberta Court of Appeal’s recent Redwater decision, where it ruled that creditors of a bankrupt operator have first rights on proceeds from the sale of the operator’s wells.17 Those proceeds are not required to go towards reclamation of the bankrupt debtor’s inactive wells. This has the potential to leave even more wells orphaned than before.

pg3,4

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With assistance from RFF Visiting Fellows Nathan Richardson (University of South Carolina) and Lucija Muehlenbachs (University of Calgary)

Inactive wells

Regulatory, environmentalist, academic and industry attention has focused much more on the environmental consequences of oil and gas development from active wells than on those from inactive wells, or wells that have ceased production. This focus is understandable given concerns about drilling, fracking, waste handling and the like; but there are many more inactive wells than active wells—one estimate suggests that at least 3.5 million oil and gas wells have been drilled in North America (Brandt et al. 2014), of which 825,000 are currently in production.1 The remaining wells are presumably inactive.
Left unplugged or not properly plugged, inactive wells threaten human and environmental health. Recent research suggests that these wells can leak methane (a powerful greenhouse gas) into the atmosphere (Kang et al. 2014). They could also provide a pathway for surface runoff, brine, or hydrocarbon fluids to contaminate surface water and groundwater (Kell 2011; King and King 2013; King and Valencia 2014). Well sites that are not properly reclaimed can contribute to habitat fragmentation (Drohan et al. 2012) and soil erosion, and equipment left on-site can interfere with agricultural land use and threaten wildlife habitat (DOI 2015). Whether even properly plugged wells can leak is still an open question.

- Inactive wells can leak pollutants, including methane and brine, as well as heavy metals and naturally occurring radioactive substances; these pollutants may contaminate groundwater, surface water, or, in the case of methane, be released into the atmosphere.

- The pathways through which leakage may occur are well documented in the literature. These pathways include mechanical integrity failure, failed well casings, and cement failure. Well construction and well plugging regulations should protect against these failures.

- The likelihood of leakage from an inactive well depends on a number of factors, most importantly, the quality of well construction at the time it was drilled and the abandonment measures that have been taken.

1 This total may be an underestimate—many historic wells were drilled before well-permitting regulations were introduced and thus may not be recorded.

Pollutants and Impacts

Methane is the primary pollutant of concern in natural gas. Methane from leaking wells enters the atmosphere directly, contributing to greenhouse gas emissions concentrations (Dusseault et al. 2000; Kang et al. 2014). Methane can also pose human health risks when entering shallow groundwater or surface water and contaminating household drinking water. Methane poses an explosion and an asphyxiation hazard,2 either during well water extraction or by accumulating in basements and well pits (Jackson et al. 2013).3 Other pollutants of concern in natural gas include nitrogen oxides, sulfur dioxide, and hazardous air toxics like benzene, toluene, ethylbenzene, and xylene (Lattanzio 2013).

Brine is another key pollutant that can migrate from hydrocarbon formations to surface water or freshwater aquifers, rendering the water non-potable, particularly if the brine has elevated total dissolved solids or contains naturally occurring heavy metals, such as barium, and radioactive materials (Jackson et al. 2013). Pollutants in surface runoff may also flow into an unplugged wellbore and contaminate groundwater (API 1993).

2 This asphyxiation hazard arises as a result of methane's ability to displace the oxygen in an enclosed space.
3 It should be noted, however, that leaking wells are not the only source of methane. The presence of natural seepage pathways allows methane to migrate slowly from hydrocarbon zones to the surface (King and King 2013). pg 6

Mechanical integrity failure.

The wellhead or Christmas-tree assembly may be inadequate to contain fluids, creating a pathway for methane to leak to the atmosphere (API 1993).

Casing failure. Casing may fail due to failed casing joints, casing collapse from sustained casing pressure, and/or corrosion over time due to the presence of brine or of hydrogen sulfide, which forms sulfuric acid upon contact with water (Davies et al. 2014; Watson and Bachu 2009; King and King 2013).

Cement failure. Multiple issues can contribute to cement failure. For instance, cement may shrink over time. This is particularly likely if the water content in the cement is too high, which causes the cement to lose water while setting (Dusseault et al. 2000). This causes a microannulus to develop between the cement and the rock wall and/or casing. There is a possibility that all wells plugged with cement will eventually leak, given enough time, due to this issue of cement shrinkage (Kunz 2015), although this has not been supported by empirical research. These basic pathways can cause leaks regardless of whether the well has been permanently abandoned, temporarily abandoned, or merely shut in. pg 8

Other Oil and Gas Activities Another crucial factor influencing leakage potential is the presence of a pressure gradient or fluid buoyancy gradient within the wellbore. If there are unplugged or improperly plugged wells in an area, it becomes especially important to pay attention to the likelihood that the hydrocarbon formation that these wells penetrate becomes repressurized. Re-pressurization may occur due to nearby gas drilling, completion, and well Resources for the Future | Ho et al. www.rff.org | 11 stimulation activities (Jackson et al. 2013). For instance, the injection of fluids at high pressure during hydraulic fracturing can pressurize nearby offset wells that have not been shut-in (Dusseault and Jackson 2014). The pressure from the injection of CO2 if a formation is used for CO2 storage also presents a similar risk (Watson and Bachu 2009). Alternatively, the buoyancy of the CO2 may itself cause CO2 leakage to the surface after it has been injected. pg 10

Subsurface Geology The subsurface geology of the area around an inactive-plugged or inactive unplugged well can influence the leakage potential of the well both by increasing the risk that a leakage pathway will develop and by influencing the pressure or fluid buoyancy gradient. Wet areas and hydrogen sulfide-bearing zones can all accelerate corrosion (King and King 2013). Salt zones may increase the risk that cement will be contaminated by salt and set prematurely, thus compromising the long term integrity of the cement plug (NPC 2011). High-pressure areas may also increase the risk of fluid migration; King and King (2013) estimate that wells in these environments may have a life of a decade or less before permanent plugging and abandonment is required.

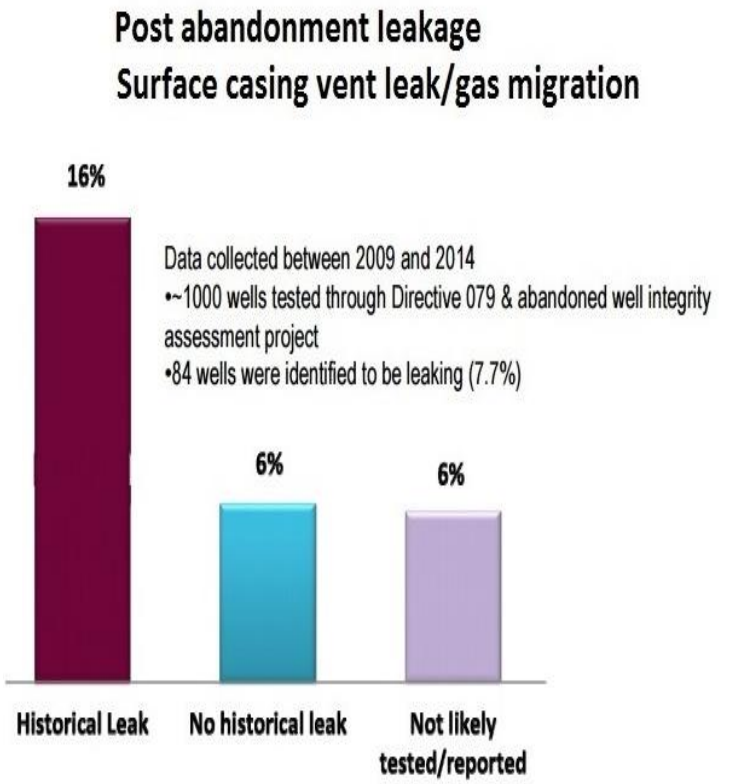
http://www.rff.org/files/document/file/RFF-Rpt-PluggingInactiveWells.pdf

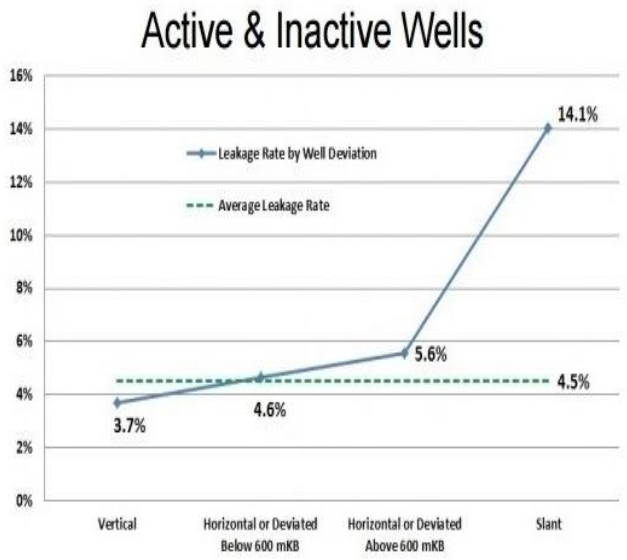
Other Factors The ownership status of a well and its location relative to water resources and/or human population centers are correlated with or contribute to environmental risk. A well's ownership status refers to whether it has a responsible operator on record. On average, orphaned wells are likely to have been drilled earlier than wells with an owner and are thus more likely to have lower-integrity well constructions and/or be in a deteriorated condition. In addition, operators may be willing and able to plug and abandon only the wells that are cheaper to plug, and may choose to leave the wells with higher plugging costs in a temporarily abandoned state or transfer these wells to smaller operators, who are more likely to default on their bonds, resulting in orphaned wells. These wells that are more expensive to plug may also be the wells that are in the worst condition and thus more environmentally risky. pg 11

Empirical Estimates of Magnitude of Pollution Potential

We discussed the issue of leakage from temporarily abandoned wells with Mark Taylor, Vice President for Climate Policy Assurance at the Alberta Energy Regulator. Data on temporarily abandoned wells in Alberta reveals that, in 2015, of 80,000 wells with this status, 5,000 were reported by owners to be leaking methane (a rate of about six percent), with an average daily leakage rate of 13 cubic meters. The maximum observed leak rate was around 500 m3 . Such wells can legally remain in this state for up to ten years, so an average leaking well could emit over this period 47,000 m3 before it returns to production or is permanently plugged. pg 12

http://www.rff.org/files/document/file/RFF-Rpt-PluggingInactiveWells.pdf



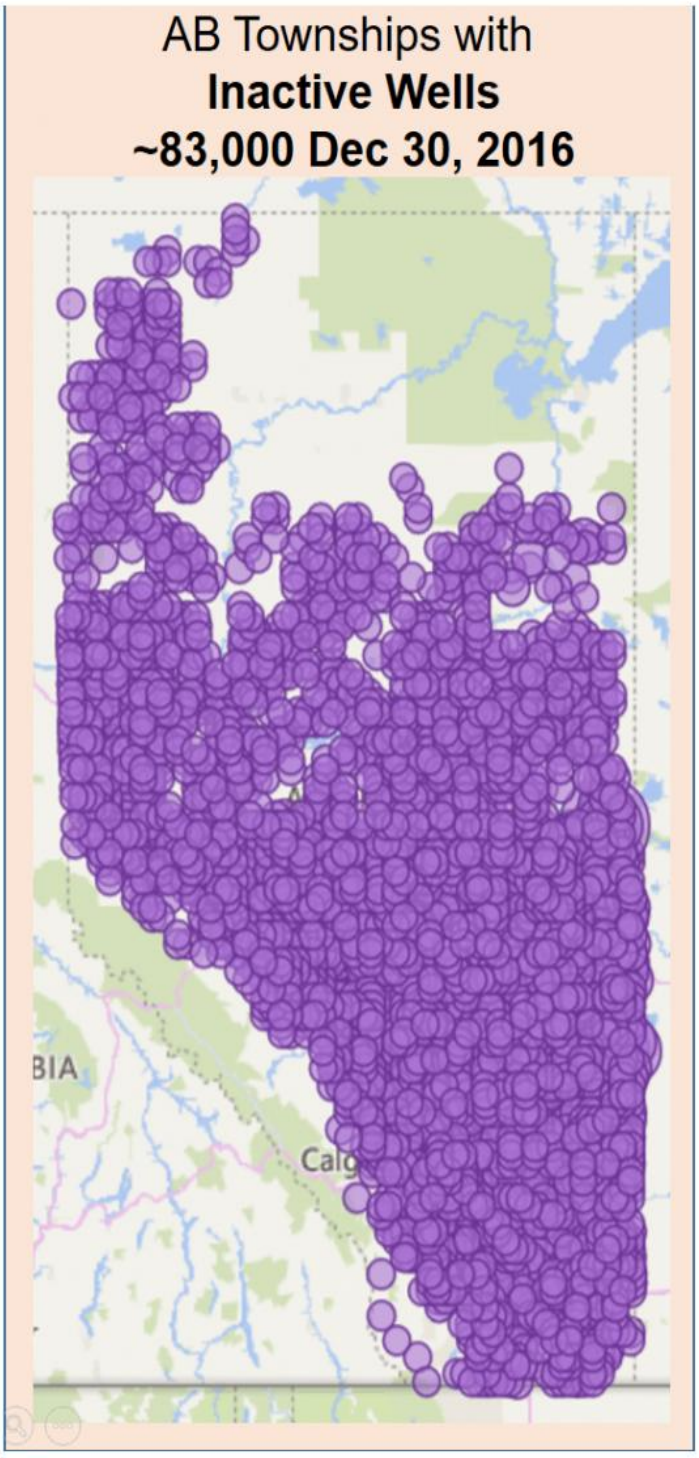


http://iogcc.ok.gov/Websites/iogcc/images/2015Utah/Alberta_Energy_Regulator-Hardie.pdf

How many inactive wells are in Alberta?

Explanation:
There were about **83000 Inactive Wells** according to an Alberta Energy Regulator (AER) file published on Jan. 29, 2016. The file also forecasted about another **7000** to become inactive. Both the current and forecast Inactive wells are distributed throughout the province. Clicking on a Meridian (4, 5 or 6) will vertically segment the map--unclick all Meridians to see all points on map. Click on a chart bar to change the map; click again to reset map. Typing Township names in the Search box will focus the map to just those locations.
Data Sources: AER Oct 31, 2016 - Inactive and Forecast excel file; AltaLIS - ATS V4.1 Polygons

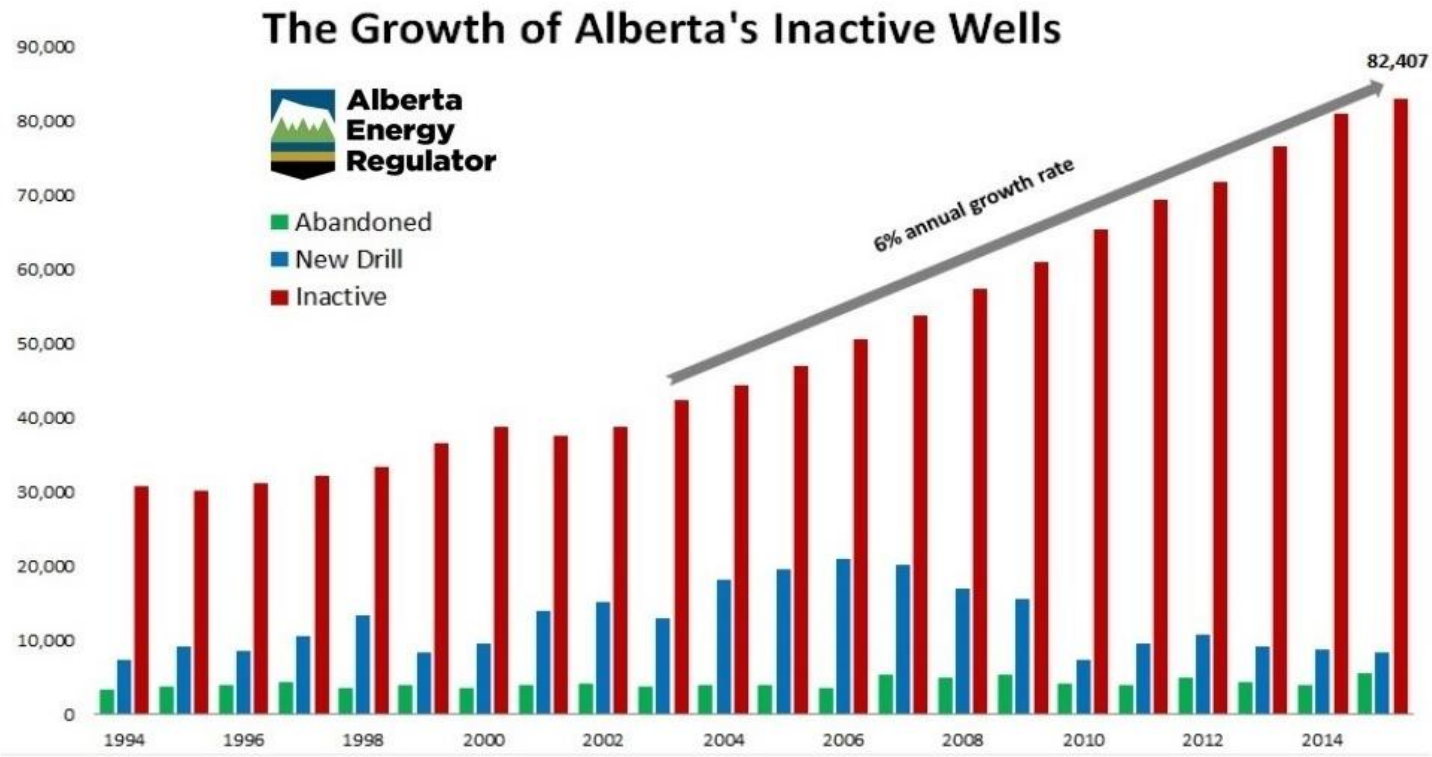
Current to this Report Date:	1/29/2017
Inactive Wells:	83014
Inactive Wells Forecast:	7119
Total Selected Wells:	90133

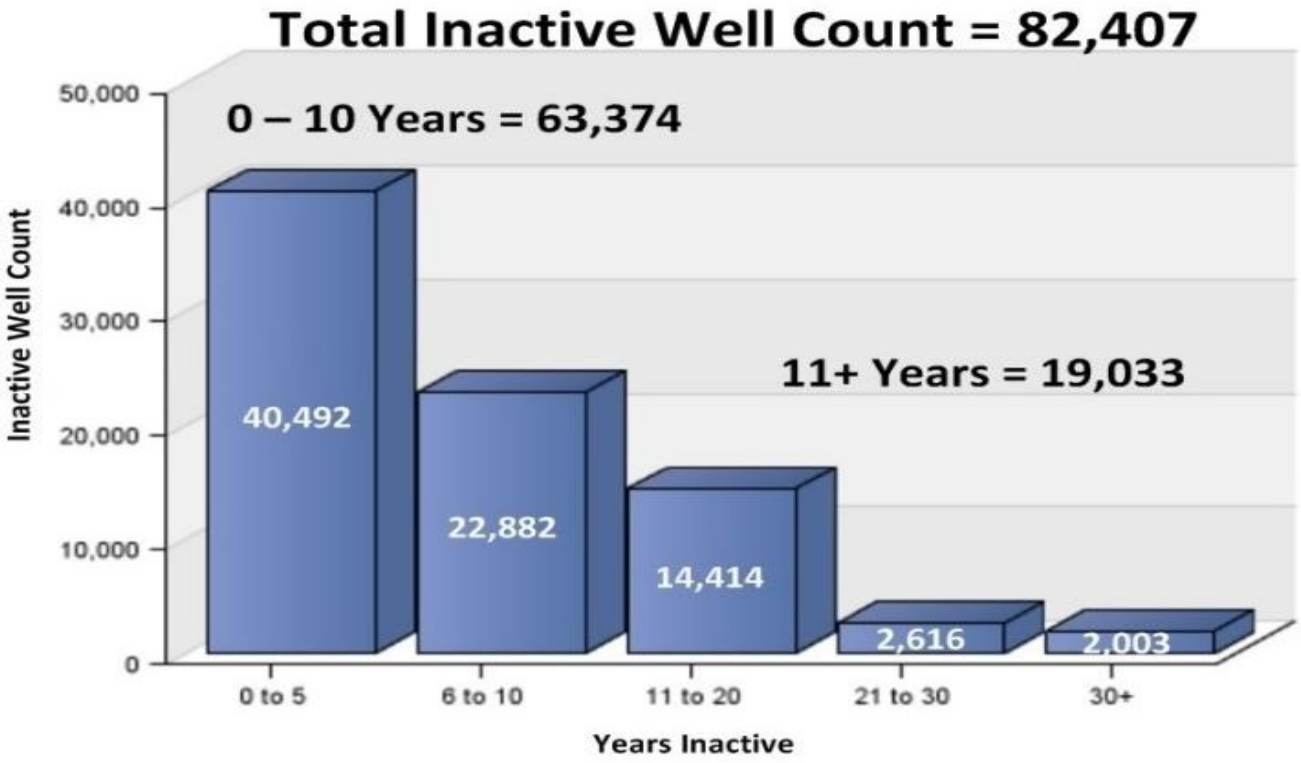


https://www.fuzeium.com/oil-gas-dashboard-demos/how-many-inactive-wells-are-in-alberta/#content

Alberta currently operates 174,000 wells, and has 82,407 inactive.
AB has a 2-1 active to inactive well ratio

https://www.aer.ca/about-aer/what-we-do





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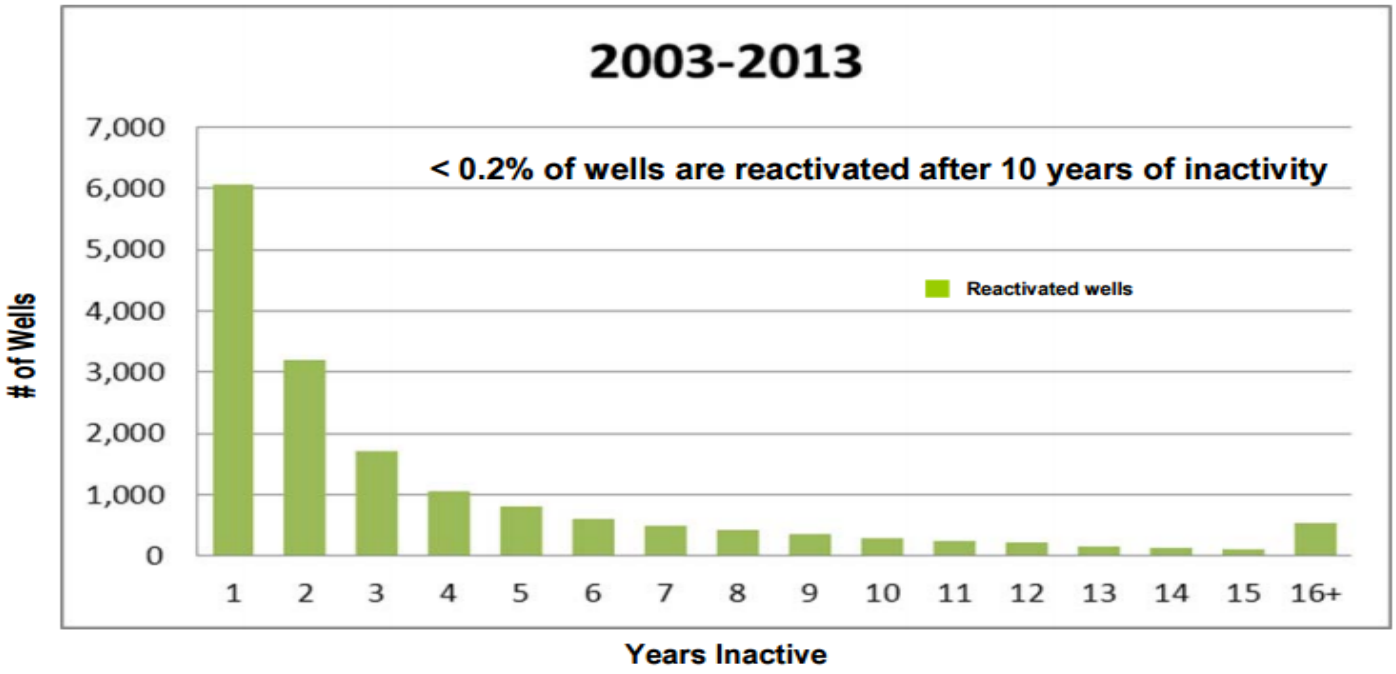
Reactivation of Wells



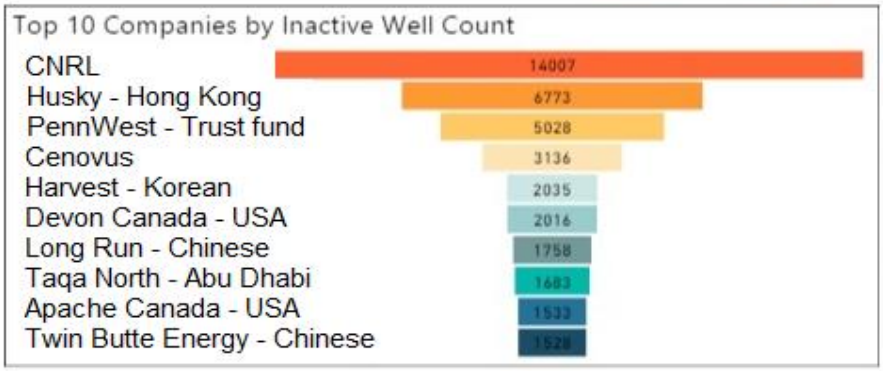
http://iogcc.ok.gov/Websites/iogcc/images/2015Utah/Alberta_Energy_Regulator-Hardie.pdf

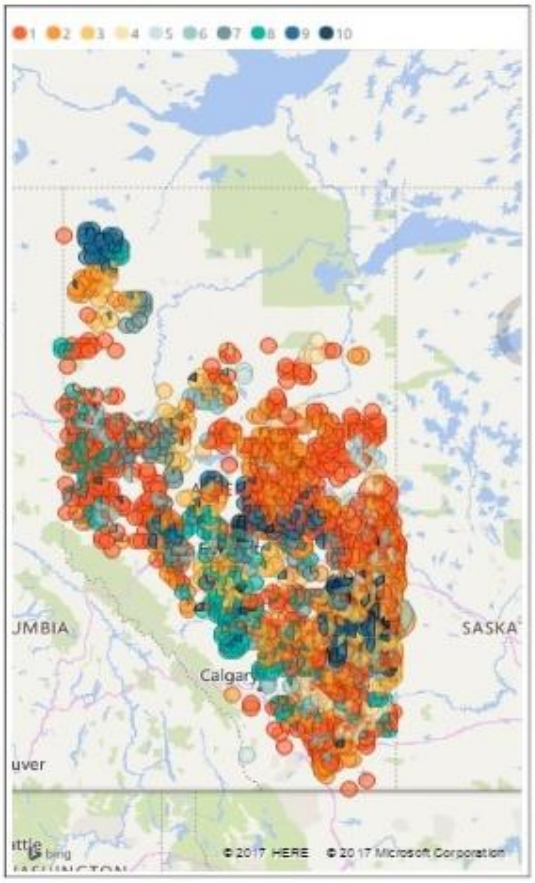
Who are the Top 10 Companies with Inactive Wells in Alberta?

Explanation:
The top 10 companies (out of 635 with Inactive Wells) were ranked as of 01/29/2017. Their total represented 48% of all Inactive Wells. The top 3 companies as of that date represented 31% of all Inactive Wells. Clicking on a Meridian (4, 5 or 6) will vertically segment the map--unclick all Meridians to see all points on the map. Click on a chart bar to change the map; click again to reset map. Typing Township Names in the Search will focus the map to just those locations.

Data Sources: AER - 10/31/2016 Inactive and Forecast excel file; AltaLIS - ATS V4.1 Polygons

Current to this Report Date:		1/29/2017
Total Number of Companies with Inactive Wells:		635
Total Inactive Wells:		83014
Selected Inactive Wells:	39497	48 %





https://www.fuzeium.com/oil-gas-dashboard-demos/who-are-the-top-10-companies-with-inactive-wells-in-alberta/#content

CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

Overview

DATE November 20, 2015
TO Alberta Royalty Review Panel
SUBJECT Liability Management

During the course of CAPP's October 27th presentation to the Alberta Royalty Review Panel the issue of liability management emerged as an area that may potentially be addressed through the royalty framework to ensure that no future generation of Albertans (without the benefits of resource development revenue) are burdened with the costs of remediation of legacy infrastructure. A request was made of CAPP to return to the panel with considerations on how best to achieve this goal with specific recommendations in relation to the royalty framework and how it can incentivize the timely abandonment and reclamation of assets no longer in operation.

2. Licensee Liability Rating (LLR) and the mitigation of orphan wells

The LLR Program is the current liability management system that tests for each licensee's financial capability to extinguish their liabilities. In addition, there are various regulatory instruments in place that govern the suspension, abandonment and decommissioning requirements. The prime objective of this approach is to ensure that the current system prevents the costs to suspend, abandon, remediate, and reclaim a well, facility, or pipeline in the LLR Program from being borne by the rest of industry should a licensee become defunct. This approach is guided by the following principles:

Current State

- Licensee failures in the form of business insolvency, transfers the responsibility of their liability to the Orphan Program which is funded by industry.
- The AER LLR Program mitigates the risk of licensee failures by conducting a monthly assessment on each licensed operator's ability to address its suspension, abandonment, remediation, and reclamation liabilities; operators that fail the viability test in the assessment are required to pay a security deposit equal to the difference between deemed liabilities and deemed assets to a maximum asset-liability ratio of 1.
- The program is designed to work towards an ideal future state in which the costs of extinguishing liability risk is not borne by the rest of industry, hence the risk to the industry Orphan fund is minimized. These long term objectives can be achieved through continuous improvement by introducing changes that can enhance the robustness of the LLR viability test.
- The LLR Program protects industry, and industry protects the public.

3. Legacy Infrastructure:

There is currently an inventory of industrial infrastructure (wells, sites, facilities, and pipelines) that were previously abandoned and reclaimed by non-defaulting companies, who had extinguished liabilities to the standard of the day and are no longer in existence.

Summary and Recommendations

- As the inventory of legacy infrastructure continues to grow over time, it is critical for government, regulators, and industry to be proactive in developing a funding model to finance the potential liabilities outlined above.
- By its very design, the Orphan Program alone cannot possibly finance the aggregate of past, current, and future legacy infrastructure issues.

Recommendation

CAPP recommends that a full integrated review be undertaken immediately that looks at the policy, regulatory, and financial assurance elements of the liability management system with recommendations and advice provided to the crown by mid-2016.

As of March 2015, there were roughly 443,900 wells in Alberta[1]. The breakdown of this inventory is illustrated in Table 1.

Table 1 – Breakdown of all wells in Alberta by well status

Well Status	Description	Count	% of Total
Active	Wells that are actively used to produce or inject fluids.	196,686	44.3%
Non-Active	Wells that are not actively used to produce or inject fluids.	77,626	17.5%
Abandoned	Wells that are sealed to the regulatory standard of the day, and cannot be used to produce or inject fluids.	63,072	14.2%
Re-Entered	Abandoned wells that were re-entered to be used to produce or inject fluids again.	2,654	0.6%
Rec Certified	Well sites that were remediated and/or reclaimed to the regulatory standard of the day.	67,328	15.2%
Rec Exempt	Well sites that were exempt remediated and/or reclaimed to the regulatory standard of the day.	36,534	8.2%
Total		**443,900**	**100%**

https://letstalkroyalties.ca/wp-content/uploads/2015/11/11-23-2015_CAPPs-Liability-Management-Recommendation.pdf

How Many Orphan Wells Exist in Alberta?

Explanation:
The OWA (Orphan Well Association) has the mandate to manage the **abandonment** and **reclamation** of Alberta oil and gas wells that no longer have an owner. These ownerless wells are known as "orphan wells". The total number of orphan wells (to be abandoned and to be reclaimed) was 2287 (as of Feb. 8, 2017). Much of the province is covered with the exception of the northeast corner of the province. Click on a chart bar to change the map; click again to reset map.

Note: The larger the circle, the more orphan wells in a Township. The plotted "pie" shows the proportion of orphan wells by the need "to abandon" and "to reclaim".

Data Sources: OWA - Abandon PDF OWA - Reclaim PDF AltaLIS - ATS V4.1 Polygons

Well Counts are Current to this Report 2/8/2017

Total number of Wells: 2287

To Abandon:	1
To Reclaim:	(Blank)
Sum of Wells:	1

https://www.fuzeium.com/oil-gas-dashboard-demos/how-many-orphan-wells-exist-in-alberta/#content

Alberta Oil and Gas Orphan Abandonment and Reclamation Association

Orphan Well Association

Orphan Well Inventory	Feb 2017	Dec 2016	Oct 2016	Sept 2016	Mar 2016	Feb 2016	Mar 2015	Mar 2014	Mar 2013	% Change
Well abandonments	**2636**	1395	1360	1285	856	683	705	162	74	+3462%
Well reclamations	697	688	663	657	540	533	451	416	387	+ 80%
Pipeline abandonments	1670	1617	1687	1353	856	821	730	121	66	+ 2430%

http://www.orphanwell.ca/pg_orphan_well_list.html

- In 2014/15, pipeline abandonments (in this context, pipeline refers to pipeline segments) were put on a lower priority to well abandonments due to a limited budget
- In 2016 the OWA completed 185 well abandonments

Orphan Well Inventory	
Reported as of March 31, 2015	705 wells
New wells received in fiscal year	258 wells
Completed well abandonments	- 185 wells
Other well closure	- 10 wells
As of March 31, 2016	768 wells

Table 3 – Well Abandonment Count

Fiscal Year (Apr 1 to Mar 31)	Prior Years	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	Total
Well Abd OWA	403	3	5	7	17	8	14	18	43	185	703
Well Abd ENF	136	3	0	0	0	1	9	27	8	2	186
Well Abd Count	**539**	**6**	**5**	**7**	**17**	**9**	**23**	**45**	**51**	**187**	**889**

http://www.orphanwell.ca/OWA%202015-16%20Ann%20Rpt%20Final.pdf

1 Purpose of the LLR Program

The purpose of the Alberta Energy Regulator (AER) LLR Program and licence transfer process as set out in this directive is to

- prevent the costs to suspend, abandon, remediate, and reclaim a well, facility, or pipeline in the LLR Program from being borne by the public of Alberta should a licensee become defunct, and
- minimize the risk to the Orphan Fund posed by the unfunded liability of licences in the program.

Licensee Liability Rating (LLR) Program is the liability management program governing most conventional upstream oil and gas wells, facilities, and pipelines, as specified in appendix 1 of *Directive 006*.

2.5 Pipelines

A pipeline licence is not considered in the calculation of deemed liabilities unless it is a designated problem site.

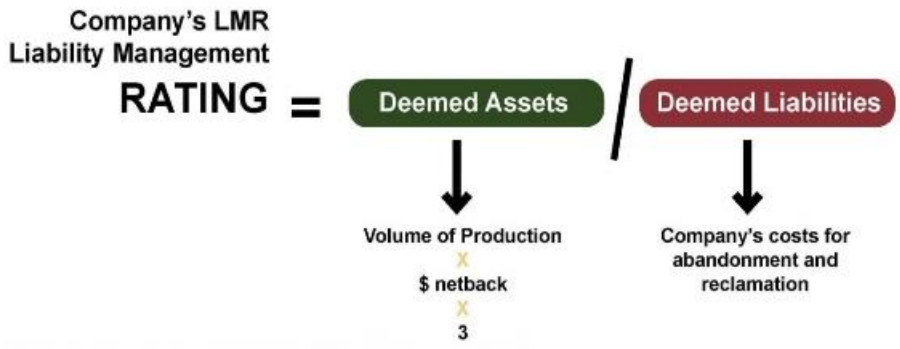
https://www.aer.ca/rules-and-regulations/directives/directive-006

How does the LLR Program work?

Each licensee with the AER receives a Liability Management Rating (LMR) based on the following formula:

LMR = Deemed Assets
Deemed Liabilities

When a licensee's LMR dips below 1.0, the licensee must post a security deposit with the AER. The amount of the security will be equal to the deemed liabilities minus the deemed assets.



How are deemed assets and deemed liabilities calculated?

Deemed Assets = Volume of Production x Netback x 3

The volume of production is determined by the licensee's reported production of oil and gas in the preceding 12 calendar months.

The industry netback is calculated by the 3 year industry average netback. Currently 2008-2010 netbacks from the Canadian Association of Petroleum Producers are being used.

http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/ofa16061

Alberta Energy Regulator

Liability Management Programs Results Report

Liability Run ID: 37480

Liability Run Date: February 04, 2017

Liability Management Rating (LMR)

Industry LMR Threshold:	1.00	
Industry Average LMR:	4.45	
Number of Licensees at or over Industry Threshold:	411	
Number of Licensees below Industry Threshold:	348	46% of AB oil + gas companies below 1.0
Total Number of Licensees Evaluated:	759	-37 companies in past 12 months
Total Number of Licences/Approvals Evaluated:	345,689	Total # of licensed wells in AB
Total Deemed Assets:	$133,856,377,418.29	Calculated using 2008 - 2010 netback amounts
Total Deemed Liabilities:	$30,099,838,578.17	Estimated using 2012 costs
Total Estimated Liabilities:	$30,538,559,193.17	-$6,107,141,760.00 reduction in liabilites in 12 months
Total LMR Security Held:	$221,176,692.70	0.7% securities held in trust against $30 billion in liabilities

Liability Management (LMR) Rating Summary

LMR Range	Number of Licensees	Number of Licences/ Approvals	Total Deemed Assets	Total Deemed Liabilities	LMR Value
0.00	236	1,634	$849.99	$141,534,240.18	0.00
0.01 - 0.49	45	3,048	$115,238,537.59	$278,046,917.45	0.41
0.50 - 0.99	67	7,748	$502,003,700.96	$604,613,817.44	0.83

+59 million in liabilities in 12 months

236 companies have had 0 production in 24 months

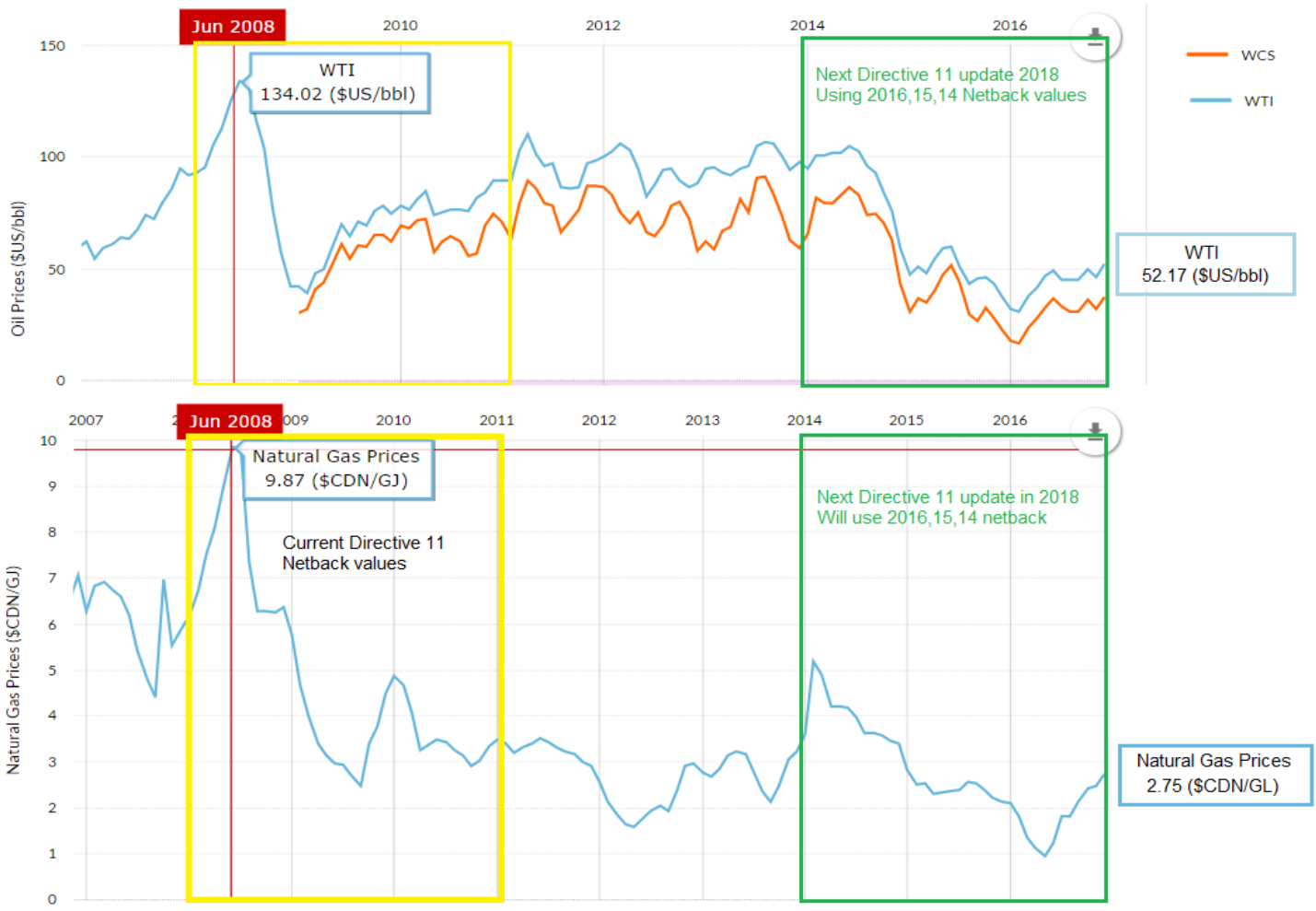
12,430 wells

$617 million assets

$1.024 billion liabilities

-$406 million Securities difference

http://www.aer.ca/data/facilities/LLR_Report.pdf



economicdashboard.alberta.ca/oilprice

Cleaning of Pipelines for Abandonment

Alberta Innovates - Technology Futures. Sept 2015

By: Tamer Crosby, Desiree Joe, Amanda Prefontaine and Haralampos Tsaprailis

Executive Summary

As the pipeline infrastructure grows and ages across Canada, abandonment and/or discontinuation of pipelines may increase as well. The process of abandonment/discontinuation needs to be properly handled and executed in order to minimize or eliminate any potential related issues. Communities' stakeholders have raised concerns about the safety of the pipeline abandonment process and about the related long term effects, especially in agricultural areas. For pipelines abandoned in place, the issue of cleanliness is a crucial one and of major concern from environmental and economic standpoints. An abandoned pipeline will inevitably corrode and could lose structural integrity posing the risk of releasing any residual contaminants into the surrounding soil and groundwater. Therefore, assessing the effectiveness of cleaning technologies for pipelines and investigating residual contaminants and methods to detect them are crucial topics that need to be properly addressed.

At the end of 2012, the AER data tallied 415,152 km of pipelines within the province of Alberta. Of Alberta's total pipeline inventory, 60.3 % carries natural gas, 14.8 % carries oil effluent (mixed oil, gas, and water production from an oil well; also known as multiphase), 5.9 % carries oilfield water, 4.9 % carries crude oil, 5.4 % carries sour gas (natural gas with hydrogen sulphide concentrations greater than 1 %), and 8.7 % carries other substances (Alberta Energy Regulator, 2013). Most of the pipelines in the province are small diameter pipes with an outside diameter of 168.3 mm (6 inches) or smaller with transmission pipelines consisting of only 2 % of the total pipeline inventory regulated by the AER. Although this report focuses on transmission pipelines, it is worth noting that about 17 % of the AER inventory is discontinued or abandoned.

Typically, the abandonment of a pipeline happens when a company decides to remove the pipeline permanently from service. If the removal from service is temporary, with the intent of reactivating the line, the action is referred to as deactivation or discontinuation. The terms deactivation and discontinuation are used for pipelines under the jurisdictions of the NEB and the AER, respectively. An abandoned pipeline may be removed from the ground, or it may be cleaned, treated, and left in place (Canada. National Energy Board, Regulating Pipeline Abandonment, June 2011). The choice for pipeline removal or abandonment in place depends on different factors such as future development plans for the land, impact of disturbing the landscape, and cost of removal, among others. Therefore, it is very important to gather all the necessary and relevant information before developing and proceeding with an abandonment plan.

Communities' stakeholders have raised concerns about the safety of the process of pipeline abandonment and the related long term effects, especially in agricultural areas (Godin, 2014). Final Report PARSC 004 and 005 12 For pipelines that will be abandoned in place, the issue of pipe cleanliness is related to corrosion and the creation of water conduits. Eventually, the pipe will corrode and become perforated and, aided by the destructive forces of the freeze-thawing of infiltrated water, the structural integrity of the abandoned pipeline will degrade. The problem then rises when the life of the contaminants is longer than the rate of deterioration, which imposes a possibility for leakage of contaminant into the ground.

Studies have shown that significant quantities of contaminants may be left behind in abandoned pipelines as a result of poor pigging and chemical cleaning practices (Det Norske Veritas, 2010). These remaining residuals could cause future issues primarily by directly contaminating the soil when the integrity of the abandoned line is compromised or by creating an environment within the abandoned pipeline that is conducive to internal corrosion.

pg11,12

http://www.ptac.org/attachments/1957/download

RESIDUAL CONTAMINANTS

Residual contaminants that may remain in an abandoned pipeline could accelerate the corrosion and failure of the pipe, which in turn may lead to the release of contaminants to the environments. Potential sources of pipe contamination were listed in (Canada. Canadian Association of Petroleum Products, Canadian Energy Pipeline Association, Alberta Energy and Utilities Board, & National Energy Board, 1996). For example, deposited substances on the Final Report PARSC 004 and 005 24 walls of a pipeline, deposited treatment chemicals, degraded coatings, leaks and spills, and PCB contamination, were all considered sources of possible contaminants.

Table 6: Potential Contaminant in a Pipeline Based on the Commodity Transported

Media	Contaminant
Crude Oil	- Organic scale deposits (Paraffins, asphaltenes, and naphthenates).
Gas	- Organic scale deposits; - Mercury based scales; - Arsenic based scales; - Zinc based scales; and - Lead based scales.
Water	- Corrosion deposits (iron carbonate, iron oxides, hydroxides, oxyhydroxides, and iron sulfide).

The main methodology employed in gathering information was one-on-one and/or telephone interviews with stakeholders. The stakeholders identified in this study were federal and provincial regulators (the NEB and the AER), pipeline operators (mainly oil and gas transmission companies), and pipeline cleaning suppliers (mechanical and chemical). pg 23,24

Summary Notes from AER Interview:

- AER regulates ~ 290,000 pipeline segments.
- At the end of 2012, there was ~ 34,500 km of discontinued and 37,000 km of abandoned pipelines licensed in Alberta.
- AER Pipeline Regulations requires pipeline owner to have perpetual liability for abandoned pipelines in Alberta.
- The licensee is responsible for abandoned pipelines. If the assets are sold, the responsibility is transferred to new owner.
- There are no specified inspection intervals although operators are required to conduct pipeline monitoring and inspection as necessary to maintain operational integrity. Once a pipeline is abandoned, there is no expectation that pipeline integrity is to be maintained.
- Although, operators will still perform scheduled right of way (ROW) inspections. ROW inspection will show if the pipeline has been exposed above ground over time.
- AER does not regularly inspect during the pipeline abandonment process. Although,AER can direct licensees to correct any deficiencies.
- The AER does not hold hearings prior to pipeline abandonments and there is no application for pipeline abandonment.
- The land owner is contacted by operator and can request removal but it is not required by legislation.

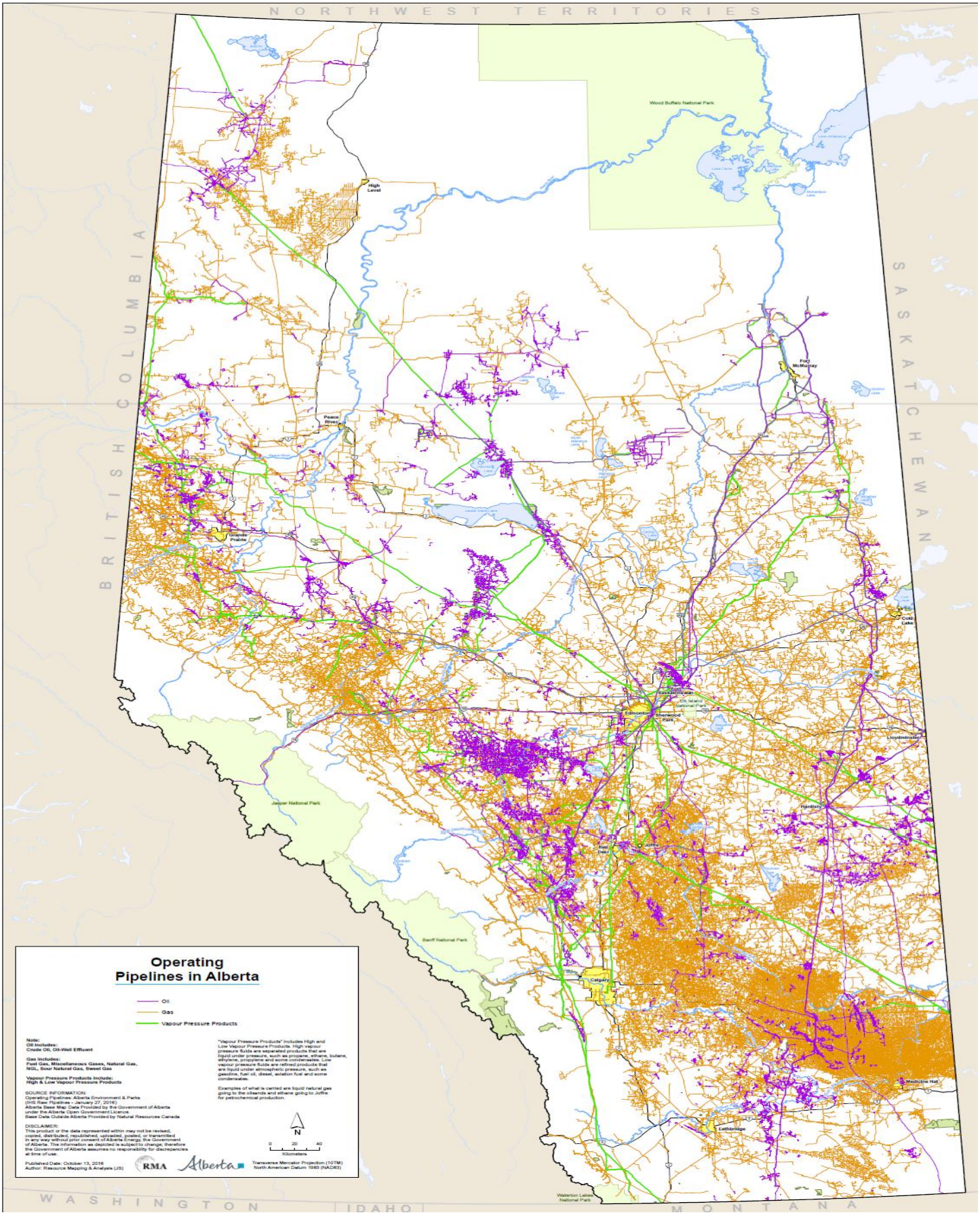
http://www.ptac.org/attachments/1957/download pg 38,39

Requirements for cleaning methods/standards of cleanliness in the regulations are goal based:

- Line must be cleaned and purged of fluids.
- Licensees are to make their best reasonable effort.
- Guiding principle is to not leave anything behind that could leak or cause or contamination.
- Although the regulations are goal-based, there are no specifications on cleaning methods for abandoned pipelines or levels of residual contaminants left in a pipeline.
- ~ 99 % of pipelines are abandoned in place.
- Preferable to leave pipelines in place. Removal of the pipeline could result in soil admixing and/or vegetation cross contamination from machinery used to dig and remove the pipeline.
- Removal of pipelines used in water systems raises the concerns of NORMs from the pipe scale.
- Any salvage value is far exceeded by removal costs.
- There are no foreseeable changes in the regulations at least in the short term.
- Some older lines were not really set up to be pigged (e.g. small diameters, tight bends, diameter changes). In this case, rinsing with water is used.
- There is no third-party inspection to the abandonment process and it is left to the due diligence of the operators. There are random checks from time to time.
- The licensee's responsibilities are to purge and clean the pipeline, isolate and cap it, notify landowners as required, amend the AER licence record, and change and keep the appropriate records of abandonment.
- Operators pay no property taxes on abandoned pipelines, only on operating (full tax rate) and discontinued ones (10% tax rate). pg 39,40

http://www.ptac.org/attachments/1957/download

What Alberta's 431,000 km of oil and gas pipelines looks like



http://www.energy.alberta.ca/LandAccess/pdfs/oil_pipelines_Map.pdf

Key points to remember:

- Alberta Taxpayers face increasing environmental and financial risk from oil and gas wells and related infrastructure
- There is no guarantee oil and gas wells and infrastructure will ever be cleaned up
- 99% of pipelines are going to be left in the ground
- The AER has virtually no regulations on pipeline abandonments
- The Orphan well program is not designed to handle the current and future workload of wells, pipelines and facilities
- 236 Oil and Gas companies (31% of all O+G companies in AB) have had 0 production in the last 24 months
- Values used to calculate LLR asset value, are misleading and grossly overstated
- Values used to estimate LLR liabilities are outdated and don't reflect the true cost of liabilities
- Because of the REDWATER court case in 2016, banks get paid first, AB taxpayers are last in line when a company goes bankrupt and directors have no liability for their companies mess
- There are no regulated timelines for abandonment of oil and gas wells in Alberta
- "Suspended" wells can remain so indefinitely
- Only 0.7% of $30 billion in liabilities is posted as security deposit in the LLR program
- There has never been a comprehensive study conducted to fully understand aging oil and gas infrastructure in Alberta
- The LLR program does not include Oil Sands mining liabilities
- Currently 83,000 "inactive wells" in Alberta
- 431,000 km of pipelines currently in Alberta
- 345,689 current well licenses in Alberta Energy Regulator LLR program
- Alberta has a total of 444,174 wells

Report Links:

1: https://www.policyschool.ca/wp-content/uploads/2017/02/Inactive-Oil-Wells-Muehlenbachs-1.pdf

2: http://www.rff.org/files/document/file/RFF-Rpt-PluggingInactiveWells.pdf

3: http://iogcc.ok.gov/Websites/iogcc/images/2015Utah/Alberta_Energy_Regulator-Hardie.pdf

4: https://www.fuzeium.com/oil-gas-dashboard-demos/how-many-inactive-wells-are-in-alberta/#content

5: https://www.fuzeium.com/oil-gas-dashboard-demos/who-are-the-top-10-companies-with-inactive-wells-in-alberta/#content

6: https://letstalkroyalties.ca/wp-content/uploads/2015/11/11-23-2015_CAPPs-Liability-Management-Recommendation.pdf

7: https://www.fuzeium.com/oil-gas-dashboard-demos/how-many-orphan-wells-exist-in-alberta/#content

8: http://www.orphanwell.ca/pg_orphan_well_list.html

9: http://www.orphanwell.ca/OWA%202015-16%20Ann%20Rpt%20Final.pdf

10: https://www.aer.ca/rules-and-regulations/directives/directive-006

11: https://www.aer.ca/rules-and-regulations/directives/directive-011

12: https://www.aer.ca/rules-and-regulations/directives/directive-013

13: http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/ofa16061

14: http://www.aer.ca/data/facilities/LLR_Report.pdf

15: economicdashboard.alberta.ca/oilprice

16: http://www.energy.alberta.ca/LandAccess/pdfs/oil_pipelines_Map.pdf

17: http://www.ptac.org/attachments/1957/download

Additional Links:

1: http://www.nationalobserver.com/2017/02/27/news/albertas-oil-and-gas-wells-are-triggering-multibillion-dollar-bill

2: http://www.bnn.ca/commodities/video/former-oil-worker-proposes-solution-to-abandoned-pipelines~1059817

3: https://thetyee.ca/News/2017/02/13/Inactive-Wells-Alberta/

4: http://www.cbc.ca/news/canada/calgary/time-limit-old-oil-and-gas-wells-1.3973018

5: http://www.psac.ca/psac-requests-federal-assistance-for-oil-gas-services-sector/

6: http://www.jwnenergy.com/article/2017/2/alberta-oil-and-gas-operators-face-over-2-billion-environmental-llr-liabilities/

7: https://www.osler.com/en/resources/regulations/2016/implications-of-the-redwater-decision-where-does

8: https://www.aer.ca/LicenseeLiabilityRating(LLR)ProgramChanges_June_2015.mp4